



ISO/IEC JTC1/SC22  
Languages  
Secretariat: CANADA (SCC)

ISO/IEC JTC1/SC22

# N554

OCTOBER 1988

TITLE: SC22/WG11 Proposal for a NWI for WG11 on:  
A Language-Independent Arithmetic Standard

SOURCE: Secretariat ISO/JTC1/SC22

WORK ITEM: JTC1.22.17

STATUS: New

CROSS REFERENCE: N/A

DOCUMENT TYPE: NWI Proposal

ACTION: For action as appropriate by SC22 Member  
Bodies. The enclosed letter ballot should  
be returned to the SC22 Secretariat by  
1989-01-20.

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Address reply to: ISO/IEC JTC1/SC22 Secretariat  
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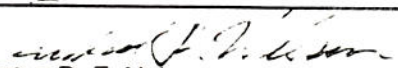
PROPOSAL FOR A NEW WORK ITEM	
date of presentation of proposal August 1988	proposer SC22/WG11
secretariat ANSI	ISO/TC ISO/IEC JTC 1

FORM 3

A proposal for a new work item shall be submitted to the secretariat of the technical committee concerned, with a copy to the Central Secretariat. The proposer may be a member body, another technical committee, a sub-committee, a Council committee, the Secretary-General or an organization outside ISO.

**Presentation of the proposal** – to be completed by the proposer

Guidelines for proposing and justifying a new work item are given in ISO Guide 26. For ease of reference an extract is given overleaf.

<b>Title</b> (subject to be covered and type of standard, e.g. terminology, method of test, performance requirements, etc.) A Language-Independent Arithmetic Standard	
<b>Scope</b> (and field of application) To prepare a language-independent arithmetic standard as a subdivision of SC22.17 - Common Language-Independent Data Types.	
<b>Purpose and justification</b> – attach a separate page as annex, if necessary See Attachment	
<b>Relevant documents to be considered</b> See Attachment	
<b>Liaison organizations</b> ANSI X3T2	
<b>Preparatory work offered with target date(s)</b> See attachment	
<b>Concerns known patented items</b> (see annex 1E of the Directives) <input type="checkbox"/> yes <input checked="" type="checkbox"/> no If yes, provide full information at annex.	 Signature D. F. Nelson Convenor, WG11

**Comments and recommendations of the TC secretariat** – attach a separate page as annex, if necessary

Comments with respect to the proposal in general, and recommendations thereon
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**Voting on the proposal**

As stated in 2.5.1 of the Directives for the technical work of ISO, each P-member of the technical committee has an obligation to vote within the time limits laid down (normally three months after the date of circulation)

Date of circulation	Closing date for voting	Signature of the TC secretary
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Scientific computing requires that numerical calculations are performed accurately and reliably with good performance. Currently, programming language standards do not specify the arithmetic properties of numeric data types in sufficient detail to demonstrate the predictability and accuracy of numerical calculations. This proposed standard is designed to fill that gap.

#### Objectives:

The objectives of the proposed standard are, in decreasing order of priority:

1. to specify requirements that will ensure that numeric data types possess the properties needed by numerical analysts to deduce the correctness of conventional algorithms;
2. to allow rigorous conformance testing of language processors;
3. to be formulated in such a way as to permit most computer systems to conform to the Standard; and
4. to avoid conflict with the requirements of the main programming language standards.

The work of W. S. Brown ("A simple but realistic model of floating point computation" ACM Transactions on Mathematical Software, Vol 7, No 4, December 1981.) has shown how some of these objectives can be reconciled for floating point. No problems are envisaged with integer data types.

Machines are different in the basic characteristics of their numeric data types and therefore such a standard would have to be parameterized (for instance, for floating point by giving the radix, mantissa length and exponent range).

#### Relationship with other Standards:

Work on project 22.17 (Specification for a Set of Common Language-Independent Data Types) has shown that there is a need to specify numeric data types in more detail than the generality of data types. The proposed subdivision of 22.17 to allow the development of a language-independent arithmetic standard would permit this to be done in a well-structured way. For some purposes the requirements of the Common Language-Independent Data Types Standard will be sufficient, but for others they will need to be supplemented by the requirements proposed standard (see objectives).

The only current international standard for floating point is IEC Publication number 559 (published in 1982), which is based upon a draft of the IEEE Standard, Standard for Binary Floating-Point Arithmetic, IEEE 754-1985. IEEE 754, however, does not address objectives 3 and 4 above, being a standard for a particular form of floating point. Conformance to IEEE 754 should imply conformance to the standard proposed here (to satisfy objective 3).

Also, the proposed IEEE generalized radix floating point standard, A radix-Independent Standard for Floating-Point Arithmetic IEEE P854, does not meet requirements 3 and 4: for example a radix of 16 is not permitted, nor is truncation rather than rounding.

This work item subdivision is complementary to the existing IEEE standards and to the programming language standards. The IEEE standards and the hardware specifications used by suppliers are essentially product specifications while this proposal is a requirement specification which can be satisfied in a number of logically distinct ways. Since programming languages provide access to floating point facilities, this proposal can be viewed as a supplement to language standards.

### The Work Plan

The base documents to be used for this work are ISO/IEC JTC1/SC22/WG11 N79 (ANSI ASC-X3 document X3T2/87-112), entitled "draft proposal for a language-based arithmetic standard", and subsequent WG11 documents offering comments, discussion and further proposals. Subject to approval of the subdivision of the work item, WG11 has appointed Dr. B. A. Wichmann (UK) as project editor. In collaboration with the authors of WG11 N79 and other members of WG11 and X2T2, the project editor will develop these documents into a draft proposed standard consisting, initially, of the following parts:

Part 1: General Issues

Part 2: Integer data types

Part 3: Real data types with floating point representation

Further parts may be added in the future, but these would be subject to approval in further SC22 letter ballots.

Estimated dates for circulating first working drafts of the above: September 1988 for all three parts.

Estimated dates for submission of Draft Proposal: April 1989 for all three parts.